

REMARKS

Claims 1-20 and 24 are pending in the subject application, of which claims 1 and 18 are independent. Claims 21-23 and 25 are withdrawn. Favorable reconsideration and further examination are respectfully requested.

Claim objections

Claim 3 was objected to due to informalities. We have canceled claim 3 and, as a result, we respectfully request that the objection be withdrawn.

Claim rejections under 35 U.S.C. § 112, second paragraph

Claims 1-17 and 24 were rejected as allegedly being indefinite. The Office Action contends that the claims fail to describe a singular ceramic material.

As amended, claim 1 recites a solid solution comprising a first and a second ceramic material, wherein the first ceramic material comprises lead, zirconium, and titanium, and the second ceramic material comprises  $A_4(B_{2-2x/3}Nb_{2+2x/3})O_{11+x}V_{1-x}$ . Thus, as the Office Action appears to contend is necessary,<sup>1</sup> the solid solution of claim 1 is described in terms of the subcomponents to which it relates.

For at least the foregoing reasons, we respectfully request that the rejections be withdrawn.

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<sup>1</sup> Office Action, page 3.

Claim rejections under 35 U.S.C. § 102

Claims 1, 2, 6, 9, 11, 13, and 24 were rejected over European Patent No. 0344978

(Ushida).

Independent claim 1 is shown below.

1. A ceramic material comprising:  
a solid solution comprising:  
a first ceramic material having a perovskite structure and defining a host lattice,  
the first ceramic material comprising lead, zirconium and titanium; and  
a second ceramic material having a cryolite structure and comprising [A<sub>4</sub>(B<sub>2</sub><sub>x</sub>/3Nb<sub>2-x</sub>/3)O<sub>11+x</sub>V<sub>1-x</sub>], where A comprises barium or strontium, where B comprises strontium or calcium, where V comprises an oxygen vacancy, and where 0 ≤ x ≤ 1.

The applied art is not understood to describe or suggest at least the underlined features of claim 1 above.

More specifically, Ushida refers to a ferroelectric ceramic material being a perovskite solid solution of the formula Pb<sub>1-a</sub>Ma (Mg<sub>1/3</sub>Nb<sub>2/3</sub>)<sub>x</sub> Ti<sub>y</sub>Zr<sub>z</sub>O<sub>3</sub>, where M is Ba or Sr.<sup>2</sup> Additional oxides chosen from La<sub>2</sub>O<sub>3</sub>, Bi<sub>2</sub>O<sub>3</sub> and Nd<sub>2</sub>O<sub>3</sub>, and oxides chosen from NiO, Fe<sub>2</sub>O<sub>3</sub>, SnO<sub>2</sub> and Ta<sub>2</sub>O<sub>5</sub> are present in the solution.<sup>3</sup> The solution may further contain MnO<sub>2</sub>.<sup>4</sup>

Thus, Ushida discloses a material containing Ba or Sr, Pb, Zr, Ti, O, Mg, and Nb. However, if the general formula of Ushida is separated, a ceramic material having a perovskite structure and comprising lead, zirconium and titanium (e.g., Pb<sub>1-a</sub>Ti<sub>y</sub>Zr<sub>z</sub>O<sub>3</sub>) would result in the remaining formula Ma(Mg<sub>1/3</sub>Nb<sub>2/3</sub>). This remaining formula is not understood to correspond to a cryolite structure. For example, paragraph 0018 of the published subject application discloses an example of a cryolite structure from which other cryolite structures can be derived:

<sup>2</sup> Ushida, page 3, lines 18-19.

<sup>3</sup> *Id.*, page 3, lines 20-24.

<sup>4</sup> *Id.*, page 3, line 37.

$\text{Na}_2(\text{Na},\text{Al})\text{F}_6$ . Accordingly, the formula  $\text{Ma}(\text{Mg}_{1/3}\text{Nb}_{2/3})$  that would result from separating Ushida's formula would lack an element corresponding to the "F<sub>6</sub>" element of the example cryolite structure disclosed in the subject application.

Furthermore, according to the general formula of Ushida, the amount of Pb is dependent on the amount of M, where Pb and M have indices of "a" and "1-a," respectively. In contrast, the amount of Pb in the first ceramic material recited in claim 1 does not depend on an amount of A in the second ceramic material.

For at least the foregoing reasons, claim 1 is believed to be patentable over Ushida.

Independent claim 18 was rejected over "Effect of net PbO content on mechanical and electromechanical properties of lead zirconate titanate ceramics" (Garg).

Independent 18 is shown below.

18. A ceramic comprising:  
a material having a formula  $A_{1-b-c}B_bC_c$ , where  $0 \leq b \leq 0.5$  and  $0 < c \leq 0.01$ ;  
wherein:  
A comprises  $\text{Pb}(\text{Zr}_a\text{Ti}_{1-a})\text{O}_3$ , where  $0.5 \leq a \leq 0.6$ ;  
B comprises an additional component having a perovskite lattice-type structure;  
and  
C comprises a ceramic material having a cryolite lattice-type structure.

The applied art is not understood to describe or suggest at least the underlined features of claim 18 above.

More specifically, Garg refers to the effect of excess PbO content of up to 1 wt% on a lead zirconate titanate ceramic.<sup>5</sup> Garg further discloses a ceramic having the components  $\text{Pb}(\text{Zr}_{0.5358}\text{Ti}_{0.456})\text{O}_3$  and PbO. In contrast, in addition to reciting that the material includes component A that comprises  $\text{Pb}(\text{Zr}_a\text{Ti}_{1-a})\text{O}_3$ , independent claim 18 also recites that the material

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<sup>5</sup> Garg, Abstract.

comprises a component C that has a cryolite lattice-type structure. According to German counsel, Garg appears to be silent with regard to at least this feature of independent claim 18.

For at least the foregoing reasons, independent claim 18 is believed to be patentable over the applied art.

Dependent claims are believed to define patentable features. Each dependent claim partakes in the novelty of its corresponding independent claim and, as such, the dependent claims have not been discussed specifically herein.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

We believe the application is in condition for allowance, which action is respectfully requested.

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Page : 11 of 11

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Respectfully submitted,

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